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(54) Heat insulating material

(57) A heat-insulating material comprises a resiliently flexible washable textile material and a heat-reflective foil. The heat-reflective foil may comprise a very thin layer of aluminium foil coated on both sides with a polyester and/or polyethylene film or a polyester film having an aluminium coating applied to both sides and which is adhered to the textile material by means of a washable flexible adhesive e.g. polyurethane which may be in the form of a foam. The insulating material may be formed conveniently into articles selected from the following;- indoor and outdoor clothing; footwear and linings for footwear; sleeping bags and linings and covers for sleeping bags; tents and groundsheets for tents; and hypothermia prevention blankets and other medical blankets and clothing.

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FIG. 1

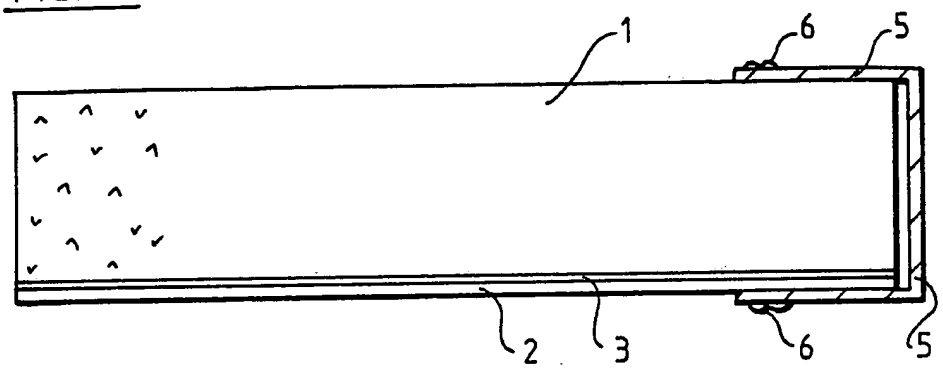


FIG. 2

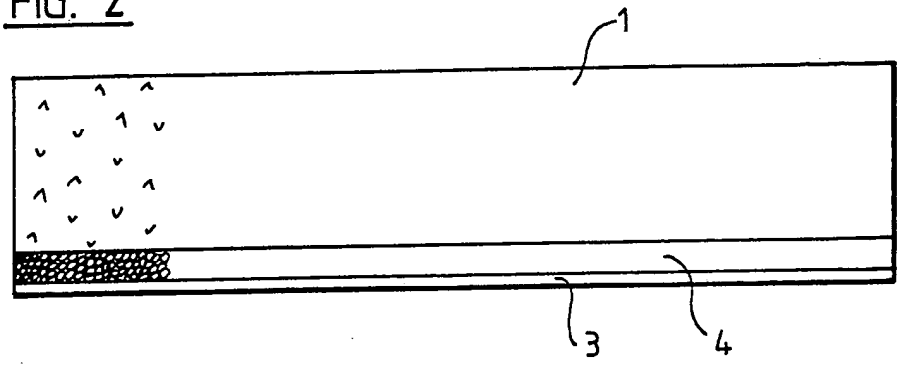
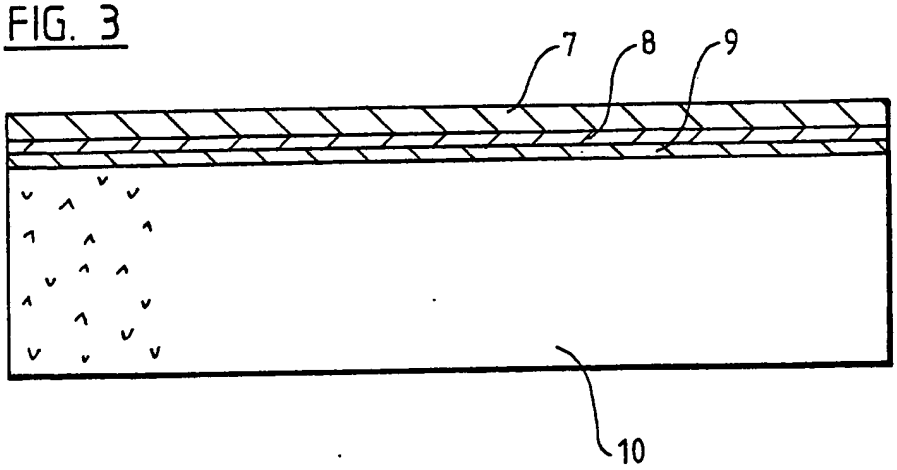


FIG. 3



Improved Heat Insulating Material

This invention relates to a heat insulating material.

Heat insulating materials consisting of woven or non-woven fabrics are known and have been used, for a considerable period of time, on a variety of different articles such as thermal insulating blankets and thermal undergarments.

Such thermal insulating materials act by trapping small pockets of air within the material to provide a combination layer having a relatively low thermal conductivity. However, the effectiveness of such materials can be reduced as the air in the pockets is replaced by a liquid with a higher thermal conductivity than the air. The presence of liquid can be due to many causes but of particular concern is incontinence of the wearer of a blanket or water penetration of clothing made from the material.

Such materials suffer from the disadvantage that significant amounts of heat from the object to be kept warm can still pass through the insulating material, albeit at a reduced rate than if no material were present.

Thin plastics films very thinly coated with metal have been used to reflect the heat emitted from the object to be kept warm back into the object itself. Although reflective films or foils can reflect a relatively high proportion of heat back into the warm object they are not in themselves very resilient and cannot be re-used to any significant degree. A further problem with such reflective foils is that they are uncomfortable to wear for any extended period of time as they tend to adhere to damp or wet surfaces and once

wrinkled or creased they tend to be very difficult to smooth out. In any case, certain types of very thin foil can be torn or damaged very easily, by, for example, the action of even a premature baby pulling the foil.

It will also be appreciated that reflective foils, comprising a metal/plastics/metal 3 layer sandwich, cannot be washed in a normal domestic situation very efficiently or without damage.

A review of the known prior art would tend to imply that the use of a heat insulating textile material has a number of important disadvantages and the use of a foil also has a number of important disadvantages. More importantly though, it will be realised that the disadvantages of one material are not countered by the advantages of the other material. In other words, a review of the above prior art would point very much away from using a textile material alone or a foil material alone, but, very importantly, it would also point away from using a combination of insulating textile material and reflecting foil.

It is an object of the present invention to overcome the disadvantages of the above prior art and to provide, at least, an improved heat insulating material which is resilient, re-usable and washable.

According to the present invention an improved heat insulating material incorporates a resiliently flexible heat-insulating textile material and a strongly heat reflective plastics-coated conductive metal film over at least part of the total contact surfaces, to at least one side of the textile material.

In a preferred embodiment, the reflective foil is attached to the textile material by means of a film of adhesive applied to at least one side of the textile

material.

In a further preferred embodiment the reflective film comprises a very thin layer of aluminium coated, on both sides, with a polyester/mylar/polythene plastics film. The textile material preferably comprises a non-woven cloth which consists of a polypropylene flat-tape scrim having a fibre composition of approximately 30% nylon and 70% viscose.

According to another aspect of the present invention, a method of manufacturing an improved heat insulating material comprises the steps of:- applying a film of adhesive to one side of either the textile material, or the reflective film or foil, placing the reflective foil or the textile material respectively in contact with the adhesive film, pressing the textile material and the reflective foil together by means of an arrangement of rollers and allowing the adhesive to cure.

The adhesive may be applied to the textile material in the form of a foam, in which case, the adhesive may be pressed into the fibres or at least some of the spaces between the fibres by means of a compression arrangement of heated rollers.

The adhesive may be cured by means of a high-frequency welder.

According to a further aspect of the present invention a bedcovering material or article, or a clothing material or article incorporates an improved heat insulating material in accordance with or manufactured to the invention as defined above.

Two embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a cross-sectional view through an improved heat insulating material manufactured in

accordance with the invention;

Figure 2 is a cross-sectional view through a part finished improved heat insulating material manufactured in accordance with the invention; and,

Figure 3 is a cross-sectional view through an alternative embodiment of an improved heat insulating material manufactured in accordance with the present invention.

An improved heat insulating material manufactured in accordance with the present invention generally comprises an insulating textile material 1 and a heat reflective foil or film 2 which are held together by means of an adhesive film 3.

In this embodiment, the insulating textile material 1 comprises a non-woven polypropylene flat tape scrim consisting of a mixture of 70% viscose and 30% nylon. In its normal, non-compressed state, the material has a thickness of approximately 2mm and a weight density of approximately 7.5 ounces per square yard.

The textile material is constructed so that small pockets of air are trapped between the fibres to provide a relatively soft and flexible but hard wearing material, having a relatively low thermal conductivity. In certain circumstances, the material can be used in embodiments where its electrically non-conducting properties could be taken advantage of, such as in respect of electrically heated blankets and duvets. It is also envisaged that such a material (or a similar textile material) could be treated to enhance any water repellant properties.

The reflective foil or film 2 comprises a polyester mylar film having a thin aluminium coating applied to both sides so that the overall thickness is 12 gauge. To the human eye, the reflective foil appears to

consist of a thin mirror film which reflects visible light but the most important optical property of the foil is its reflectivity in respect of the infra red range of light. The reflectivity of the foil in that range must be as high as reasonably possible since such a foil will return the maximum amount of the heat emitted from the object to be kept warm to the object itself. It is also envisaged that other reflective foils (possibly of a more complex construction than hitherto) instead of being highly reflective from both sides could have a very high reflectivity from one side of the film and a very low reflectivity from the other side of the film. In this manner, if the object to be kept warm were to be placed on the highly reflective side then any heat emitted from the object would be returned to the object and any heat falling on the other side of the film would pass through the film and into the object.

It is also envisaged that any such reflective foil could be constructed to allow the passage of vapours but not liquids, which would allow the foil to "breathe" and thus be more comfortable for a person to wear. Alternatively, the reflective foil could be constructed to allow vapours and liquids to pass through small holes or porous regions of the foil.

The adhesive film 3 can, in principle, comprise any adhesive which will adhere the foil 2 to the textile material 1 but, in use, certain adhesives are preferable. As improved heat insulating materials will come into contact with moisture (of various forms) the adhesive 3 should possess the property of being resistant to water and, possibly, to dry cleaning fluids and other washing solutions.

In addition, since the improved heat insulating material will be at least partially flexible the adhesive

also should be sufficiently flexible so that it will not cease to have adhesive effect after extended use or flexing. If the material is to be used in respect of electrically heated blankets or duvets, then the adhesive should be electrically non-conductive.

Referring now to Figure 2, a partially manufactured improved heat insulating material generally comprises an insulating textile material 1 and a heat reflective foil or film 2 which are spaced apart by a layer of adhesive in the form of a foam 4.

To manufacture a heat insulating material both the textile material 1 and the reflective foil 2 are cut to size and the textile material 1 is hung in vertical orientation in a vertical spray booth. Adhesive (either in the form of a simple liquid 3 or a foam 4) is then evenly sprayed onto a major proportion of one side of the textile material 1, the sprayed textile removed from the spray booth and placed, adhesive side uppermost, onto a horizontal table. A leading edge of the cut reflective foil 2 is aligned in contact with a similar leading edge of the adhesive-sprayed textile material 1 and the remainder of the foil 2 is placed in contact with the remainder of the textile material 1 so that all the respective edges are aligned.

In practice it has been found that for relatively small pieces of improved heat insulating material it is satisfactory to apply the foil to the textile material manually. However, for very wide and/or very long pieces of heat insulating material it would be desirable to utilise an automatic or semi-automatic process. Accordingly, it would be a requirement that any machine used to apply the foil to the textile material must be especially sensitive so that the foil can be accurately

and consistently aligned with the textile material but so that the fragile foil is not distorted, punctured or otherwise damaged by the machine.

The textile/adhesive/foil sandwich is then passed through a pair of compression rollers so that any air bubbles formed between the adhesive and the foil, and any wrinkles or creases in the foil are smoothed out. In the case that the adhesive applied to the textile material is in the form of a foam the compression rollers may be heated to change the foam into a film. Alternatively, if the adhesive is heat settable then the rollers may be heated and/or a high frequency welding device used to set the adhesive to the textile material and the reflective foil.

After the three part sandwich has been compressed together and the adhesive allowed to set, the material may be cut into smaller sizes and various finishing operations performed upon it.

A protective or aesthetically pleasing textile ribbon (as seen in Figure 1) may be located around the edges of the sandwich and stitched in place by means of conventional threads 6. If a piece of foil alone were punctured with a sewing needle then it would have a tendency to tear from the hole but, when the foil is glued to a textile material the tendency of the foil to tear from such punctures is very much reduced. Such an improved heat insulating material with a woven edging ribbon may be used, for example, as a heat insulating blanket for infants and/or infirm elderly people.

One advantage of such improved heat insulating materials having a fray-resistant edging ribbon is that they are resiliently hard wearing but flexible and can be washed and re-washed in the normal domestic environment without suffering any significant damage. Even if, after

extended use, the foil is punctured the efficiency of the material will not be reduced to any great degree since the foil will not tear and the material will remain flexible.

Referring now to the preferred embodiment of Figure 3, the improved heat insulating material comprises a polyethylene layer 7 (having a thickness of 23um); an electrically conductive aluminium layer 8; a polyester layer 9 (having a thickness of 12um); and, a textile blanket material 10.

Although the first embodiment is reasonably efficient the present embodiment has the advantage that the thin heat-reflective aluminium layer is not exposed and the insulating material as a whole is less susceptible to rubbing.

The reflective foil (7, 8, 9) is fixed to the textile material 10 by means of a polyurethane adhesive. The adhesive is resistant to water and other domestic washing solutions as well as, preferably, dry-cleaning fluid.

The reflective foil may be manufactured in a perforated arrangement whereby water vapour can pass through the improved heat insulating material. In this manner "breathable" insulation fabrics could be incorporated into clothing.

It should be appreciated that this improved heat insulating material is not limited in respect of being used for blankets and similar bedcovering materials but could also be used in respect of other articles where heat insulation is of at least some importance. A non-exhaustive, non-limiting list of such articles is as follows:- indoor and outdoor clothing including clothes for cyclists and motorcyclists, clothing for campers and

walkers, clothing for mountaineers, skiers and climbers; swimwear and clothing for underwater divers, emergency survival and rescue clothing; footwear and linings for footwear; sleeping bags and linings and covers for sleeping bags; tents and groundsheets for tents; and hypothermia prevention blankets and other medical blankets and clothing.

Throughout this specification "improved heat insulating material" refers to a material the subject of which forms the present invention.

This invention is not restricted to the details of the foregoing embodiment. The invention extends to any novel one, or any novel combination, of the features disclosed in this specification and/or drawings, or to any novel one, or any novel combination, of the steps of the method or process disclosed herein.

CLAIMS

1. An improved heat-insulating material incorporating a resiliently flexible heat-insulating textile material and a strongly heat-reflectiove plastics-coated metal foil or film, attached over at least part of the total contact surfaces to at least one side of the textile material.

2. An improved heat-insulating material according to Claim 1 wherein the reflective foil or film is attached to the textile material by means of a film of adhesive applied to at least one side of the textile material.

3. An improved heat-insulating material according to Claims 1 or 2 wherein the reflective foil or film comprises a very thin layer of aluminium coated on both sides with a polyester and/or polythylene film.

4. An improved heat-insulating material according to Claim 1, 2 or 3 wherein the textile material comprises a polypropylene flat-tape scrim.

5. An improved heat-insulating material according to Claim 4 wherein the scrim is composed of approximately 30% nylon and 70% viscose.

6. An improved heat-insulating material according to any of Claims 1 to 5 wherein the reflective film or foil is attached to the textile material by means of a polyurethane adhesive.

7. An improved heat-insulating material according to any of Claims 1 to 6 wherein a protective and aesthetically pleasing textile ribbon is located around the edge of the material by means of stitches.

8. An improved heat-insulating textile material comprising a washable and resiliently flexible heat-insulating textile material (the textile material containing a plurality of small air pockets contained within itself to maximise any heat insulation properties)

and a strongly heat-reflective foil; the foil comprising an outer layer of polythylene the thickness of which is approximtaley 23µm, an inner layer of polyester the thickness of which is approximately 12µm, and a very thin central layer of electrically conductive aluminium; the reflective foil being fixed to the textile material by means of a water-resistant flexible polyurethane adhesive so that, in use, the improved heat-insulating textile material maintains the body heat of an occupant by means of the combination of a high infra-red reflectivity coefficient and the heat-insulating properties of the air pockets of the textile.

9. An article of clothing incorporating an improved heat-insulating textile material according to any of Claims 1 to 8.

10. An article of clothing according to Claim 9 wherein the article so formed is selected from the following: indoor and outdoor clothing including clothes for cyclists and motorcyclists; clothing for campers and walkers; clothing for mountaineers, skiers and climbers; swimwear and clothing for underwater divers; emergency survival and rescue clothing; footwear and linings for footwear; sleeping bags and linings and covers for sleeping bags; tents and groundsheets for tents; and hypothermia prevention blankets and other medical blankets and clothing.

11. A method of manufacturing an improved heat insulating textile material which incorporates a heat-insulating textile material and a heat-reflective film or foil, the method comprising the steps of: applying a film of adhesive to one side of either the textile material, or the reflective film or foil, placing the reflective foil or the textile material respectively in contact with

the adhesive film, pressing the textile material and the reflective foil together by means of an arrangement of rollers and allowing the adhesive to cure.

12. A method of manufacturing an improved heat insulating textile material according to Claim 11 comprising the steps of applying the adhesive to the textile material in the form of a foam.

13. A method of manufacturing an improved heat insulating textile material according to Claim 12 wherein the foam adhesive is pressed into the fibres or at least some of the spaces between the fibres by means of heated compression rollers.

14. A method of manufacturing an improved heat insulating textile material according to Claims 11, 12 or 13 wherein the adhesive is cured by means of a high frequency welding apparatus.

15. An improved heat insulating material substantially as herein described with reference to the accompanying drawings.

16. A method of manufacturing an improved heat insulating material substantially as herein described with reference to the accompanying drawings.

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